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**Principles of creating environmental indicators and  
opportunities in their applications**

**Summary of PhD thesis**

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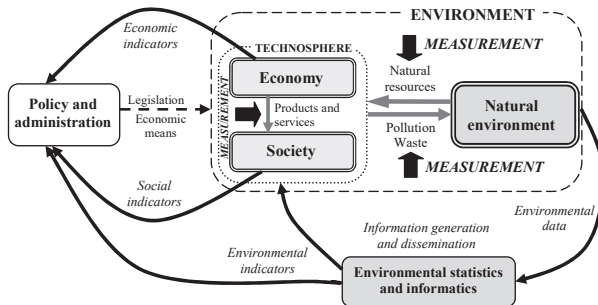


# Introduction

New information demands of economic planning and public administration in connection with new roles of governance have already been articulated at the end of 1960s but recent concerns are essentially set by other aspects such as problems accumulated till the end of 1980s to which first had been drawn attention by the reports of Club of Rome.

Among the conditions of political foundation of desirable evolution in the age of globalisation, concerns of national policy (governmental policy) on the one hand, and governance on the other hand and in general that have been growing in an extraordinary measure are to be mentioned: The main concern in planning future and implementing related programmes is that governments can not manage excess of complexity. In order to be coped with this complex set of problems, there is a need to develop a system-thinking approach that combines *social material flow* (in terms of sustainable natural resources' use of economy) and *information flow* (in terms of gathering, analysing and disseminating knowledge (*Fig. 1*).

Fig. 1: The conceptual frame of social material and information flows



Source: Own editing after Pillmann et al. (*Environmental Modelling & Software* **21**, 1519–1527, 2006)

Note: Words with italic letters show the elements connecting to information flows.

In Hungary, full transformation of the economy, which entails several environmental changes, has begun simultaneously with forming institutional system of the multi-party, plural democracy. Since 1990s, growing interest has been devoted to understandable environmental information complying requirements of transparency and accountability. By summarizing the use of environmental indicators with various dissemination aims in the latest years, thorough knowledge can be obtained about recent situation.

## Aims of the research

In the dissertation, *five problem scopes* – environmental information, conceptual clarification, environmental indicators, use of environmental indicators, and environmental reporting – were chosen for detailed examination and overall analysis together with *11 problems* assigned to them.

It was put in the focus of the dissertation that actually which orientation points (*the data*), which conceptual frames (*the models*) and which ways (*the indicators*) are worth taking into consideration in order to interpret and communicate appropriately the relevant and meaningful information and their meanings both for citizens and society (*the information flow*). Moreover, it was also investigated, on the basis of explored diagnose, how it is practical to take steps in choosing right paths of future.

On the basis of the abovementioned, the *main aim* of this doctoral dissertation is the study of potential use of environmental information and indicators in certain decision-making and dissemination process. The related central question is *in what framework can be used environmental information and indicators in effective way in sectoral policy decision-making and informing general public*.

## Methods of the research

During the entire research period *targeted literature monitoring* was carried out for exploring recent international and national results concerning environmental indicators. In addition, an historical exploration was conducted in order to draw evolutionary way that led today's epistemological situation.

The methodological background of the empirical part of the research is basically meant by exploring and using *statistical and other assessment methods* on domestic and international statistical databases.

Results crystallised during the research are based partly on *my own experiences* which have been accumulated by working in the field of national state of the environment reporting and indicator-based reporting, as well as *personal activities* in the international expert working groups such as OECD Working Group on Environmental Information and Outlooks, EEA Expert Group on the State of the Environment Reporting, UN ECE Working Group on Environmental Monitoring and Assessment.

## Research summary and theses

1. International experiences show that official statistics need to play an integrative role in environmental information system. Dealing with wide range of tasks, important developments are required both in the field of statistics and other parts of environmental information system because significant part of raw data needed to environmental statistics comes from outside of statistics, i.e. results of measurements, observations, scientific activities and different registers, therefore evolution of environmental statistics is strongly bound to information collecting systems. The principle of sustainable development makes self-evident the integration of environmental policy into sectoral policies. In the course of the last two decades environmental problems have become equal and dominant political counterpart of economic and social questions. For economic policy there are necessary means at our disposal for defining economic problems, designing answers and assessing success of responses: national accounts and theirs top aggregates. For environmental policy there is no equal tool (Szabó 1998; 2005).
2. I have always been striving during my research carrier so far, that after the precise definition of the notions let them be introduced into the Hungarian scientific literature and using them exactly and consistently, in almost all cases applying a suitable special Hungarian term—many times in the form of coinage (e.g. Szabó 2006; 2008).
3. As a result of historical exploration of the Hungarian literature I showed that in Hungary elaboration of environmental statistics and development of environmental indicators—that was not yet realised in an even wider circle—had started at an early stage of international development, and it was also manifested, in some cases, in state-of-the-environment reports, according to our recent term. The period works were not carried out in system-thinking approach but along with opportunities of strongly limited conditions, many times developments happened on an ad hoc base, generally not taking into consideration cause–effect chain (Pomázi, Szabó 2006b).
4. Exploring and analysing international experiences I compared function of environmental assessment systems of the United Nations, the OECD and the European Union which are based on pressure–state–response model. Moreover, I completed an assessment of major aspects of development and selection of indicators (Pomázi, Szabó 2006b).
5. The aim of the summarising monograph published the first results of the study carried out for the Carpathian territory of Hungary is to introduce major characteristics of social, economic and environmental situation of the region, as well as regional changes occurred

since 1970s till the political transition, and major territorial changes have been affecting since 1990s up to now (Pomázi et al. 2006). The results came from the applied set of indicators have drawn the attention adverse and positive spatial processes happening on the territory studied and contribute to the scientific foundation of the common future vision of Carpathians Environment Outlook, as well as foundation of regional developmental decisions concerning the future of macro region (Pomázi, Szabó 2007a; 2007b).

6. Precise, continuous and systematic measurement and dissemination of progress can serve not only for informing society but also can play an important role in elaboration and possible overview of governmental (and municipal) strategies, as well as in making necessary interventions. The so-called headline indicators provide good basis for presentation of distance-to-target (Pomázi, Szabó 2008a).
7. On the basis of international, especially OECD experiences—first in Hungary—I introduced concepts of decoupling and environmental profile for describing interactions between environmental pressures and economic development. By these instruments that extend circle of analysis methods, it is possible to quantify the existing quality relations between environmental loads and economic activities either at national or regional level (Szabó 2006).
8. By studying relevant international scientific literature thoroughly, I concluded that indicators derived from economy-wide material flow accounts provide us with aggregated information on the composition and changes of the physical structure of the social and economic system. Material flow accounting is a useful tool for analysing interactions of economy and the environment, as well as for deriving environmental and integrated environmental, social and economic indicators (Szabó, Pomázi 2006a; Pomázi, Szabó 2006a; 2006b; 2006c).
9. I explored—as far as I know first in Hungary—long time series and cross-cutting evolution of nearly full range of metabolic compartments (material and energy flows) of Budapest between 1955 and 2005 (Pomázi, Szabó 2008b; 2008c).
10. On the basis of development of a hierarchical system of environmental indicators, I identified major target areas and target groups for applying environmental indicators. By experiences and feedbacks received so far, the system adapted and extended for Hungarian situations on the basis of international practice is suitable for providing inquiry and information on the environment at different level (Pomázi, Szabó 2006b).

11. On the basis of extended overview of literature, by assessing 90 different types of national and international environmental reports and compendia, I revealed that timeliness of environmental reports can not be improved significantly under current conditions of information flow structure. Of the possible ways of improvement are to be highlighted the spread of electronic presentation and updating, as well as use of nowcasting methodology together with conscious use of preliminary data based on expert estimations (Szabó 2009).

## Conclusions

1. **Fusion (integration) of flow of environmental information, as well as information from monitoring and observation systems and statistical surveys at governmental level provides environmental policy decisions and actions to be made, controlled and accounted.** At governmental level, an effort should be made in order to get the appropriate harmonisation of the process of statistical and monitoring elements of the integrated environmental and economic information system be developed (on the basis and continuation of the 6-year program between 1996 and 2002 on the development of environmental information system in the field of environmental statistics).
2. **Exact and consistent use of old and recent notions in the Hungarian environmental protection and environmental statistical terminology which were proposed by me can provide precise understanding and relevant applications.** Moreover, they assist in reasoning of arguments and ideas, as well as efficiency and effectiveness of communication among different stakeholders.
3. **Hungary—although knew international development trends, and some of them it participated in effectively—until mid-1990s did not deal actively with systemic putting of environmental indicators into practice.** Studies and methodological development of indicators made by or for international organisations such as OECD, EU and UN, according to period literature exploration, got an impulse in the beginning of 1980s, exploded in 1990s, and consolidated early 2000s. In Hungary, history of the development and use of environmental indicators can be divided as follows: 1. (realising) stage (from mid 1970s to 1994): active and passive attention periods altered with active and passive work periods; 2. (evolutionary) stage (1994–2005): systemic accomplishment of active attention and active work; 3. (operative) stage (2005 onward): consolidation of active attention and activity field.

4. **I developed a system of indicators' set which is capable, in longer term and in operative form for monitoring environmental pressures, states and societal responses in Hungary.** The system of indicators' set tested in governmental practice served as a basis of the series of publications that proved big need of such documents with systemic development and generality not only in governmental work but also in informing public audience.
5. **The system of indicators' set developed for Hungary can be used in wider geographical context, and it copes with challenges at international level (e. g. Carpathians Environmental Outlook).** The system of indicators' set can serve as a ground of a much wider research presenting environmental, economic and social (regional) processes which includes both the Carpathians and the Carpathian basin.
6. **The use of "good" indicators is indispensable for designing scenarios assisted planning and formulating target settings which helps to avoid exaggerated expectations or indicative target settings that are without real challenges. Eligible environmental indicators selected carefully make it possible to be accountable posteriorly therefore environmental indicators can be considered as tools of societal control of spending public financial sources.** In environmental planning (sub)sectoral policy targets are expedient to define in virtue of necessary bases (assessment of the state of the environment) which mean dominant elements of a feasible and accountable programme.
7. **The phenomenon of decoupling (delinking of environmental pressure and economic growth) can be interpreted not only at national level but it can also contribute to more precise analysis of regional processes.** By scrutiny of the procedure of decoupling at regional level, the typology of the trends in environmental performance and projections of possible or expected evolutionary paths are made possible.
8. **Indicators related to material flow accounting make possible comparisons with similar aggregated economic indicators and indices, so they help in shifting the attention of policy from purely financial analysis toward integration with biological and physical aspects.** The present form of the system of national accounts should be extended by satellite accounts (system of integrated environmental and economic accounts). Satellite accounts include material flow accounts whose regular calculation supports exploration of interrelationships between material intensity and productivity of society and eventually provide us with information on the trends of the natural resources' use.



9. **By using tools suitable for studying social metabolism such exploration can be carried out at settlement (metropolitan) level which can be an effective instrument of sustainable resource management at local level.** Calculating social metabolism at subnational scale—in spite of its several difficulties and problems not yet solved—seems specifically useful tool in order to make tangible the principles of subsidiarity and sustainable development.
10. **By elaboration and usage of the system of environmental reports in practice, the diverse users' need (decision-makers, (sub)sectoral policy-makers, general public) can be satisfied on a harmonised way.** Function of the elaborated system of environmental reports in operative form and development of a similar reporting system at regional level make the publishing process and dissemination calendar of environmental information countable and plannable.
11. **Timeliness of the environmental reports can not be improved significantly under current conditions therefore other methods are required for enhancing timeliness (e.g. electronic publishing, nowcasting etc.).** Of quality criteria of environmental reports one of the most important is timeliness whose improvement can raised judgement of other criteria as well.

## Refereed publications served for theses

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